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(54) Electrically conductive powder for mixing with cyanoacrylates and electrically conductive curable composition using the same.

(57) An electrically conductive, curable composition comprising as its main components, cyanoacrylates and metal powder and having a superior storage stability, curability at room temperature and a superior electrical conductivity after being cured, which is useful as a quick-curing adhesive, is provided, wherein the cyanoacrylate or/and the metal powder is treated so as to prevent or inhibit the property of the powder of inducing cyanoacrylate polymerization.

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TITLE OF THE INVENTION

Electrically conductive powder for mixing with cyanoacrylates and electrically conductive curable composition using the same

5 BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to an electrically conductive powder for mixing with cyanoacrylates, and an electrically conductive composition containing this powder and 10 cyanoacrylates as basic components.

Description of the Prior Art

Cyanoacrylates rapidly cure at room temperature in contact with materials to be adhered and hence have been widely used as a one-pack, non-solvent type adhesive for 15 adhering plastics, rubbers, ceramics, glass, metals, etc. in various commercial fields.

If an adhesive of the one-pack, non-solvent type, which is curable at room temperature, such as the mentioned cyanoacrylates, could be provided with electric conductivity after being 20 cured, this would be very valuable as an electrically conductive adhesive in the aspect of practical use; thus realization of such an adhesive has been desired.

However, mixtures obtained by mixing a highly electrically conductive metal powder with cyanoacrylates have 25 a much inferior storage stability and polymerize rapidly before use. Namely, metal powder has a property of notably inducing cyanoacrylate polymerization and the resulting adhesive composition is unsuitable to practical use; hence

a useful electrically conductive cyanoacrylate adhesive has never been realized.

Thus, as electrically conductive adhesives, mixtures consisting of metal powder and an epoxy resin have usually been often used, but those of the room temperature curing type have a notably inferior storage stability, whereas those of good storage stability type do not cure in a short time unless heated; hence they are practically very inconvenient.

The present inventor has made extensive research 10 in order to obtain a curable composition having a good stability and superior electrical conductivity by the use of cyanoacrylates. As a result, there was found that in the case where metal powder is subjected to a particular treatment, even when it is mixed with cyanoacrylates or 15 cyanoacrylates having a polymerization-inhibiting substance added, the resulting composition hardly causes cyanoacrylate polymerization, and when a composition consisting of such a metal powder and cyanoacrylates or cyanoacrylates having a polymerization-inhibiting substance is cured, the resulting 20 cured material has a good electrical conductivity.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an electrically conductive powder for mixing with cyanoacrylates, which, when mixed with cyanoacrylates, can afford a superior storage stability with inducing little 25 cyanoacrylate polymerization.

Another object of the present invention is to provide an electrically conductive, curable composition containing as its main agents, an electrically conductive 30 powder which induces little cyanoacrylate polymerization

at the time of storage and cyanoacrylates, and having a superior storage stability and yet good curability at room temperature and also a superior electrical conductivity in the cured state.

5 The present invention provides an electrically conductive powder for mixing with cyanoacrylates, which consists of a metal powder treated as to prevent or inhibit the property of metal powder of inducing cyanoacrylate polymerization; and an electrically conductive, curable 10 composition containing as its main components, an electrically conductive metal powder treated as above and cyanoacrylates, or as main components, an electrically conductive metal powder treated as above and cyanoacrylates having added a substance for preventing or inhibiting the property of metal powder 15 of inducing cyanoacrylate polymerization, which substance is used for the above treatment of electrically conductive powder.

An embodiment of the present invention resides in that the above electrically conductive powder for mixing with cyanoacrylates is a metal powder treated with a substance 20 which reacts with water or/and acidifies water to thereby prevent or inhibit the property of metal powder of inducing cyanoacrylate polymerization (hereinafter the substance will be referred to as cyanoacrylate polymerization-inhibiting substance).

25 Another embodiment of the present invention resides in that the above cyanoacrylate polymerization-inhibiting substance is added as an independent component besides the case where the substance is used for treating the electrically conductive powder and in the case where the substance is added 30 to cyanoacrylates.

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DETAILED DESCRIPTION OF THE INVENTION

The form of the metal powder used in the present invention has no particular limitation. For example, those in various forms such as flaky, particulate or dendritic form 5 may be used alone or in admixture.

As the metal forming the metal powder, metals having electrical conductivity, such as gold, platinum, iridium, paradium, silver, chromium, nickel, etc. and besides, various alloys of two or more components such as Ag-Cu alloy, brass, bronze, stainless 10 steel, etc. may be used. Further, a metal powder having a multi-layer structure such as that having copper at the central part and silver at the surface part may also be used, further, e.g. a powder having a substance other than metal such as glass, mica, high molecular weight polymers, etc. 15 at the central part and a metal coating the surface part may also be used as the metal powder in the present invention.

As to the substance for preventing or inhibiting the property of metal powder of inducing cyanoacrylate polymerization by its reaction with water (hereinafter referred to as reactive, polymerization-inhibiting substance), used as one of the cyanoacrylate polymerization-inhibiting substances in the present invention, its representative examples are halides of elements of the group III of the Periodic Table, such as boron trichloride, boron tribromide, 25 etc., phosgene, acetyl chloride, benzoyl bromide, acryloyl chloride, isophthaloyl dichloride, polymethacryloyl chloride, cyanuric chloride, chloroisopropyl carbonate, halides of elements of the group IV of the Periodic Table such as silicon tetrachloride, trichlorosilane, trimethylchlorosilane, 30 vinyltrichlorosilane, diphenyldichlorosilane, titanium

germanium tetrachloride, etc., nitrosyl chloride, halides
of elements of the group V of the Periodic Table such as
phosphorous trichloride, phosphorous tribromide, phosphorous
triiodide, phosphorous pentachloride, phosphorous oxychloride,
5 phenylphosphorous dichloride, dibutylphosphorous chloride,
bisphenoxyphosphorous monobromide, phenylphosphonic acid
dichloride, antimony pentachloride, vanadium tetrachloride,
etc., halides of elements of the group VI of the Periodic
Table such as sulfur chloride, thionyl chloride, sulfuryl
10 chloride, pyrosulfuryl chloride, chlorosulfonic acid,
toluenesulfonyl chloride, benzenedisulfonyl chloride, selenium
tetrachloride, chromyl chloride, etc., simple substances, i. e.
elements of the group VII of the Periodic Table or their
oxygen compounds such as chlorine, bromine, chlorine hexoxide,
15 etc., various oxygen compounds having an anhydrous acid
structure in the broad sense such as acetic anhydride, ketene,
diketene, benzoic anhydride, polysebacic anhydride, maleic
anhydride, nitrogen dioxide, phosphorous pentoxide,
polyphosphoric acid, sulfur trioxide, sulfur dioxide, fuming
20 sulfuric acid, etc., substances which are readily hydrolyzed
to produce acids such as dimethyl sulfate, methyl
toluenesulfonate, pentaerythritolbisoctyl phosphite, etc.,
and metal-containing organic compounds which are readily
reactive with water such as triethylaluminum, ethylaluminum
25 dichloride, diisobutylaluminum hydride, ethylmagnesium
bromide, aluminum triisopropoxide, etc., and among these,
substances which produce acids by the reaction with water
are particularly preferable. Of course, it is also possible
to use two or more of these compounds at the same time.

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Further, as to the substance for preventing or inhibiting the property of metal powder of inducing cyanoacrylate polymerization (such substance will hereinafter be referred to as acidic, polymerization-inhibiting substance), used as one of cyanoacrylate polymerization-inhibiting substances, its representative examples are acidic substances containing elements of the group III of the Periodic Table, such as boron trifluoride, aluminum chloride, etc., acidic substances containing elements of the group V 10 of the Periodic Table, such as nitric acid, phosphorous acid, phosphoric acid, mono-n-propyl phosphate, dibutyl phosphate, phenyl phosphonic acid, antimony pentafluoride, niobium pentafluoride, tantalum pentafluoride, etc., acidic substances containing elements of the group VI of the Periodic Table, 15 such as toluenesulfonic acid, dodecylbenzenesulfonic acid, benzenesulfinic acid, fluorosulfonic acid, etc., carboxylic acids, preferably those having a pK_a value of 3.5 or less, such as trichloroacetic acid, trifluoroacetic acid, dinitrobenzoic acid, etc., halogen acids such as hydrogen 20 fluoride, hydrogen chloride, hydrogen bromide, chloric acid, periodic acid, etc., and of course, two or more of these compounds may be used at the same time.

Further, the reactive, polymerization-inhibiting substances and the acidic, polymerization-inhibiting substances may be used alone or at the same time. The 25 treatment of metal powder with the polymerization-inhibiting substances is preferably carried out usually by making metal powder present in gas phase or liquid phase containing the polymerization-inhibiting substances and treat it with 30 stirring or without stirring. In this case, a solvent may

be used, and the temperature employed is preferably room temperature or a higher temperature. In addition, metal powder is preferably heated under reduced pressure or dried under low humidity in advance of treating the powder with the polymerization-inhibiting substances.

5 The amount of the polymerization-inhibiting substances used for treating metal powder in the present invention varies depending on the kind of metal powder, the kind of the polymerization-inhibiting substances and the manner of treating the powder with the substances, but the 10 amount is usually in the range of 0.01 to 50 parts by weight, preferably 0.1 to 10 parts by weight, based on 100 parts by weight of metal powder, in the case of the reactive, polymerization-inhibiting substances. Further, it is usually 15 in the range of 0.01 to 50 parts by weight, preferably 0.07 to 10 parts by weight, in the case of the acidic, polymerization-inhibiting substances.

Naturally, it is desirable that the metal powder used in the present invention is dried before or/and after 20 treating as above.

In the present invention, the temperature at which metal powder is dried or placed under reduced pressure has no particular limitation in a range from freezing point to high temperatures, but such high temperatures as deform the shape 25 of metal powder used are of course undesirable.

In the present invention, as to the manner in which the dried atmosphere is prepared, its representative examples are a manner wherein a drying agent is placed in an adequate closed vessel, followed by still standing, and a manner 30 employing a system in which a dry inert gas such as nitrogen,

nitrogen, argon, etc. flows continuously. Of course, drying under reduced pressure may be employed. As the drying agent, any of those of a type reacting with water, a type absorbing water and a type adsorbing water may be employed, and any 5 of acidic, neutral and alkaline agents may also be employed. Its representative examples are silica gel, calcium chloride, conc. sulfuric acid, metal sodium, slaked lime, calcium hydride and reactive, polymerization-inhibiting substances described later, and they are not added to metal powder, but 10 placed in the same atmosphere as that in which metal powder is placed, and used.

In the present invention, when metal powder is dried or treated under reduced pressure, it may be held in any state of dynamic states such as stirring, vibration, etc.

15 The metal powder for mixing with cyanoacrylates, obtained according to the present invention, is preferably placed in a dry atmosphere during the period till it is mixed with cyanoacrylates, i.e. during its storage, transportation, weighing, etc.

20 The reduced pressure employed in the present invention has no particular limitation, but it refers usually to 30 mmHg or less, preferably 10 mmHg or less, in terms of the degree of vacuum of mercury column.

Cyanoacrylates used in the present invention include 25 all of various esters of 2-cyanoacrylic acid. Their concrete examples are methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, t-butyl, amyl, n-hexyl, cyclohexyl, dodecyl, allyl, propargyl, allylbenzyl, phenyl, 2-chloroethyl, 2-cyanoethyl, pentafluoroethyl, etc. 2-cyanoacrylates, and two or more kinds 30 of these may be also used at the same time.

The reactive, polymerization-inhibiting substances and the acidic, polymerization-inhibiting substances added to cyanoacrylates consist of one or more kinds of substances described before which react with water or/and acidify water.

5 These polymerization-inhibiting substances are added either before, at the same time when or after metal powder for mixing with cyanoacrylates is mixed with cyanoacrylates.

The amount of the polymerization-inhibiting substances added to cyanoacrylates is usually in the range 10 of 10 ppm to 20,000 ppm, preferably 30 ppm to 1,000 ppm based on the weight of cyanoacrylates.

Cyanoacrylates are preferably dehydrated in advance under reduced pressure or by drying. This is due to the fact that when metal powder treated with the polymerization-inhibiting substances is used, the water content in cyanoacrylates has a larger influence as compared with conventional cyanoacrylate adhesives having no electrical conductivity so that cyanoacrylates are liable to polymerize at the time of storage.

20 The amount of cyanoacrylates used based on 100 parts by weight of electrically conductive powder for mixing with cyanoacrylates in the present invention is usually in the range of 10 to 150 parts by weight, preferably 25 to 100 parts by weight. To a mixture of the electrically conductive powder 25 with cyanoacrylates or cyanoacrylates having the polymerization-inhibiting substances added may be added a substance which assists in preventing or inhibiting the property of metal powder of inducing cyanoacrylate polymerization, such as a substance having hydroxyl group or thiol group e.g. 30 monohydric or polyhydric alcohols, phenols, thiols, etc.,

and further, known additives for cyanoacrylates such as radical polymerization inhibitors, various adhesion-enhancing substances such as acrylic copolymer rubber, solvents such as chloroform for viscosity adjustment, plasticizers such as dimethyl sebacate, thickening agents such as polymethyl methacrylate, cross-linking agents such as allyl cyanoacrylate, dyestuffs, etc. may be added in a suitable amount, if necessary.

In order to cure the electrically conductive composition of the present invention in seconds, the curing accelerator comprising amine(s) solution can be used onto the droplet of the mixed composition on a surface of a substrate.

The electrically conductive, curable composition of the present invention may be used for various applications, such as adhesives requiring electrical conductivity, applied for the adhesion of plastics, rubbers, ceramics, etc., concretely, for example, adhesion for caulking reinforcement and contact stabilization of eyelet or screw part, ceramics and metals, taking out of leads of quartz crystal oscillator, flash, cadmium sulfide meter, etc., carbon brush of motor, LED element to base, and semiconductor element of die bonding to electrode. Further there are use applications other than adhesives, e.g. for filling narrow clearances, molding electrically conductive thin films, etc.

Example 1

A purified flaky silver powder (5 g) was added to each of the solutions of various reactive, polymerization-inhibiting substances (0.2 g) shown in Table 1 dissolved in acetone (25 g) and the mixture was agitated for 30 minutes,

followed by filtering off the silver powder from the solution and drying the silver powder at 60°C for 5 hours. The thus prepared silver powder (100 parts by weight) was mixed with ethyl 2-cyanoacrylate (50 parts by weight) and the mixture 5 was preserved in a polyethylene vessel at 20°C and a relative humidity of 60%. Further, as in the case of conventional cyanoacrylate adhesives, to the mixed solution were added SO₂ (50 ppm) and hydroquinone (200 ppm) as stabilizers. After one hour, the respective solutions were adhered and cured. 10 And their viscosity, setting time, volume resistivity and tensile shear strength were respectively measured. The viscosity measurement was carried out by means of a rotational viscometer (B type viscometer). As to the setting time, one drop of the mixed liquid prepared above was attached onto 15 only the surface to be adhered of one of a pair of steel test pieces (surface to be adhered: 0.875 cm²), these pieces were placed on one another, a load of 5.0 kg/cm² was acted perpendicularly onto the adhered surface and a period of time till a generated strength by which the load was lifted was 20 measured. The volume resistivity was measured according to JIS K-6911. The tensile shear strength was measured according to JIS K-6850, using steel test pieces (dimension: 100 mm × 25 mm × 1.6 mm). The experimental results are shown in Table 1.

Table 1

	Reactive, polymerization-inhibiting substance	Measurement item			
		Viscosity (CPS)	Setting time (sec)	Volume resistivity ($\times 10^{-4} \Omega\text{-cm}$)	Tensile shear strength (kg/cm 2)
5	(1) Boron trichloride	600	600	5.5	70
	(2) Acetyl chloride	500	500	7.0	60
10	(3) Trimethylchlorosilane	550	600	5.0	80
	(4) Phosphorous oxychloride	450	420	6.5	50
	(5) Thionyl chloride	350	300	4.8	40
	(6) Chlorine hexoxide	300	240	5.0	80
	(7) Acetic anhydride	400	300	5.8	40
15	(8) Ethylaluminum dichloride	450	400	5.0	70

In addition, when non-treated silver powder was mixed with ethyl 2-cyanoacrylate, the latter polymerized within 20 seconds.

Example 2

20 A purified flaky silver powder (5 g) was added into acetone (25 g) and the mixture was agitated for 30 minutes. Further, each of various acidic, polymerization-inhibiting substances (0.5 g) was dissolved in the solution, followed by stirring for 2 hours, then filtering off the silver powder 25 from the solution, drying the resulting silver powder at 60°C for 5 hours, mixing the silver powder (100 parts by weight) thus prepared with ethyl 2-cyanoacrylate (66 parts by weight), and preserving the mixture in a polyethylene vessel at 20°C and a relative humidity of 60%. After one hour, the 30 respective mixed solutions were adhered and cured. And their viscosity, setting time, volume resistivity and tensile shear

strength were respectively measured. The measurement methods were the same as those in Example 1.

Table 2

5	Acidic, polymerization-inhibiting substance	Measurement item			
		Viscosity (CPS)	Setting time (sec)	Volume resistivity ($\times 10^{-4} \Omega \cdot \text{cm}$)	Tensile shear strength (kg/cm ²)
	(1) Aluminum chloride	380	300	6.5	80
	(2) Nitric acid	360	300	6.0	75
10	(3) Dodecylbenzenesulfonic acid	900	about 30 min.	7.5	65
	(4) Trifluoroacetic acid	400	360	4.8	85
	(5) Hydrogen fluoride	350	300	5.5	90
	(6) Dibutylphosphoric acid	350	300	6.0	80

Example 3

Phenylphosphonic acid (0.5 g) was dissolved in acetone (25 g), and a purified flaky silver powder (5 g) was added, followed by stirring for 2 hours, then filtering off the silver powder from the solution, drying the resulting silver powder at 60°C for 5 hours, mixing the thus prepared silver powder (100 parts by weight) with ethyl 2-cyanoacrylate (66 parts by weight) having various reactive, polymerization-inhibiting substances (200 ppm) dissolved therein in advance and preserving the mixture in a polyethylene vessel at 20°C and a relative humidity of 60%. In addition, chloroform (10 parts by weight) was added. After two hours, the respective mixed solutions were adhered and cured, and their viscosity, setting time, volume resistivity and tensile shear strength were measured. The measurement methods were the same as those

in Example 1.

Table 3

Reactive, polymerization-inhibiting substance	Measurement item			
	Viscosity (CPS)	Setting time (sec)	Volume resistivity ($\times 10^{-4} \Omega\text{-cm}$)	Tensile shear strength (kg/cm ²)
(1) Boron trichloride	300	210	8.5	90
(2) Acetyl chloride	200	180	8.8	80
(3) Trimethylchlorosilane	350	240	6.0	75
(4) Phosphorous oxychloride	250	180	8.0	80
(5) Thionyl chloride	240	180	9.8	90
(6) Chlorine hexoxide	400	300	8.5	70
(7) Acetic anhydride	250	180	9.0	80
(8) Ethylaluminum dichloride	350	240	6.0	60

Example 4

Thionyl chloride (0.2 g) was dissolved in acetone (25 g), and to this solution was added a silver powder (5 g) obtained by drying in vacuo for one hour under conditions of a degree of vacuum of 10 mmHg and a temperature of 60°C, followed by stirring for 30 minutes, further dissolving phenylphosphonic acid (0.5 g) and mono-n-propyl phosphate (0.2 g) in the solution, mixing them with stirring for 2 hours, then filtering off the silver powder from the solution, drying in vacuo the resulting silver powder at a degree of vacuum of 10 mmHg and a temperature of 60°C for one hour, mixing the thus prepared silver powder (100 parts by weight) with ethyl 2-cyanoacrylate (66 parts by weight) having various acidic, polymerization-inhibiting substances (100 ppm)

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dissolved therein in advance and preserving the mixture in
a polyethylene vessel at 20°C and a relative humidity of 60%.
After five hours, the respective mixed solutions were adhered
and cured, and their viscosity, setting time, volume
5 resistivity and tensile shear strength were measured. The
measurement methods were the same as those in Example 1.

Table 4

10	Acidic, polymerization-inhibiting substance	Measurement item			
		Viscosity (CPS)	Setting time (sec)	Volume resistivity ($\times 10^{-4} \Omega\text{-cm}$)	Tensile shear strength (kg/cm^2)
	(1) Aluminum chloride	380	300	8.5	70
	(2) Nitric acid	400	300	5.5	60
15	(3) Dodecylbenzene-sulfonic acid	300	240	8.0	80
	(4) Trifluoroacetic acid	250	210	8.0	90
	(5) Hydrogen fluoride	280	210	9.0	90

Example 5

A purified flaky silver powder (5 g) were dried
20 in vacuo for one hour under conditions of a degree of vacuum
of 10 mmHg and a temperature of 60°C, followed by adding the
powder to a solution of phosphorous oxychloride (0.1 g)
dissolved in acetone (25 g), followed by further dissolving
phenylphosphonic acid (0.5 g) in the solution, mixing by
stirring for 2 hours, then filtering off the silver powder
25 from the solution, drying in vacuo the resulting silver powder
for 2 hours at a degree of vacuum of 10 mmHg and a temperature
of 60°C. The thus prepared silver powder (100 parts by
weight) was mixed with ethyl 2-cyanoacrylate or methyl

2-cyanoacrylate (66 parts by weight) having phosphorous oxychloride (100 ppm) dissolved therein in advance and the mixture was preserved in a polyethylene vessel at 20°C and a relative humidity of 60%. After the respective hour(s) indicated in the following Table, the respective solutions were adhered and cured and their viscosity, setting time, volume resistivity and tensile shear strength were measured. The measurement methods were the same as those in Example 1.

Table 5

10	Cyanoacrylate	Lapse hour(s)	one hour	3 hours	5 hours
		Measurement item			
15	(1) Ethyl 2-cyanoacrylate	Viscosity (CPS)	250	300	500
		Setting time (sec)	240	300	1,000
		Volume resistivity ($\times 10^{-4} \Omega\text{-cm}$)	3.5	3.8	4.0
		Tensile shear strength (kg/cm ²)	80	80	70
20	(2) Methyl 2-cyanoacrylate	Viscosity (CPS)	250	350	600
		Setting time (sec)	240	300	1,200
		Volume resistivity ($\times 10^{-4} \Omega\text{-cm}$)	4.0	4.0	4.5
		Tensile shear strength (kg/cm ²)	100	90	90

In addition, when non-treated silver powder was added to these cyanoacrylates, the resulting solutions polymerized in about 3 minutes so that the measurement was impossible.

5 Example 6

Various purified metal powders were dried in vacuo for one hour under conditions of 60°C and a degree of vacuum of 10 mmHg, followed by adding each of the metal powder (5 g) to a solution of sulfonyl chloride (0.25 g) dissolved in acetone (25 g), stirring for 30 minutes, further dissolving phenylphosphonic acid (0.5 g) in the solution, mixing the mixture with stirring for 2 hours, then filtering off the metal powder from the solution, drying in vacuo the resulting metal powder at a degree of vacuum of 10 mmHg and 60°C for 2 hours, mixing the thus prepared metal powder (100 parts by weight) with ethyl 2-cyanoacrylate (66 parts by weight) having sulfonyl chloride (100 ppm) dissolved therein in advance and preserving the mixture in a polyethylene vessel at 20°C and a relative humidity of 60%. After one hour, the resulting mixed solutions were adhered and cured, and their viscosity, setting time, volume viscosity and tensile shear strength were measured. The measurement methods were the same as those in Example 1.

Table 6

Metal powder	Measurement item			
	Viscosity (CPS)	Setting time (sec)	Volume resistivity ($\times 10^{-4} \Omega \text{-cm}$)	Tensile shear strength (kg/cm 2)
(1) Gold	300	300	2.5	70
(2) Platinum	350	360	12.5	75
(3) Paradium	320	360	14.0	65

CLAIMS:

1. An electrically conductive powder for mixing with cyanoacrylates, which consists of a metal powder treated with a substance which reacts with water or/and acidifies water, so as to prevent or inhibit the property of metal powder of inducing cyanoacrylate polymerization.

2. An electrically conductive metal powder for mixing with cyanoacrylates according to claim 1 wherein said substance is at least one compound selected from the group consisting of halides of elements of the groups III to VI of the Periodic Table, elements of the group VII of the Periodic Table and oxygen compounds thereof, oxygen compounds having an acid anhydride group, substances which are readily hydrolyzed to produce acids and 15 metal-containing organic compounds which are readily reactive with water.

3. An electrically conductive powder for mixing with cyanoacrylates according to claim 1 wherein said substance which prevents or inhibits the property of metal powder of inducing cyanoacrylate polymerization, by acidifying water is at least one compound selected from the group consisting of acidic compounds, carboxylic acids and halogen acids, each containing elements of the groups III, V and VI of the Periodic Table.

25 4. An electrically conductive, curable composition comprising as its main components, one or more cyanoacrylates and a metal powder treated with a substance which reacts with water or/and acidifies water to thereby prevent or inhibit the property of metal powder of inducing cyanoacrylate polymerization.

5. An electrically conductive, curable composition according to claim 4, further comprising a substance which reacts with water or/and acidifies water.

6. An electrically conductive, curable composition
5 according to claim 4 wherein said substance which reacts with water is at least compound selected from the group consisting of halides of elements of the groups III to VI of the Periodic Table, simple elements of the group VII of the Periodic Table and oxygen compounds thereof, oxygen compounds
10 having an acid anhydride group, substances which are readily hydrolyzed to produce acids and metal-containing organic compounds which are readily reactive with water.

7. An electrically conductive, curable composition according to claim 5 wherein said substance which reacts with
15 water is at least compound selected from the group consisting of halides of elements of the groups III to VI of the Periodic Table, simple elements of the group VII of the Periodic Table and oxygen compounds thereof, oxygen compounds having an acid anhydride group, substances which are
20 readily hydrolyzed to produce acids and metal-containing organic compounds which are readily reactive with water.

8. An electrically conductive, curable composition according to claim 4 or claim 5, wherein said substances which acidifies water is at least one compound selected from the group
25 consisting of acidic compounds, carboxylic acids and halogen acids, each containing elements of the groups III, V and VI of the Periodic Table.



European Patent
Office

EUROPEAN SEARCH REPORT

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Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 84113218.6																					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.)																					
A	<p>CHEMICAL ABSTRACTS, vol. 85, no. 18, November 1, 1976, Columbus, Ohio, USA</p> <p>K. INOUE "Electrically conductive adhesives containing dendritic metal powders" page 872, column 2, abstract-no. 135 921b</p> <p>& JP Kokai 76/73 036</p> <p>--</p> <p>CHEMICAL ABSTRACTS, vol. 87, no. 20, November 14, 1977, Columbus, Ohio, USA</p> <p>K. INOUE "Adhesives" page 39, column 1, abstract-no. 153 082z</p> <p>& JP Kokai 77/74 626</p> <p>--</p> <p><u>FR - A1 - 2 515 196 (LOCTITE CORPORATION)</u></p> <p>* Claims 1,2; page 1, line 34 - page 3, line 4 *</p> <p>--</p> <p><u>DE - A - 2 107 188 (SCHERING AG)</u></p> <p>* Claim 1 *</p> <p>-----</p>	1,4	<p>C 09 J 3/14</p> <p>C 08 K 3/08</p> <p>H 01 B 1/22</p>																					
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<p>The present search report has been drawn up for all claims</p> <table border="1"> <tr> <td>Place of search VIENNA</td> <td>Date of completion of the search 01-02-1985</td> <td>Examiner REISER</td> </tr> <tr> <td colspan="2">CATEGORY OF CITED DOCUMENTS</td> <td> <p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p> </td> </tr> <tr> <td>X : particularly relevant if taken alone</td> <td colspan="2"></td> </tr> <tr> <td>Y : particularly relevant if combined with another document of the same category</td> <td colspan="2"></td> </tr> <tr> <td>A : technological background</td> <td colspan="2"></td> </tr> <tr> <td>O : non-written disclosure</td> <td colspan="2"></td> </tr> <tr> <td>P : intermediate document</td> <td colspan="2"></td> </tr> </table>				Place of search VIENNA	Date of completion of the search 01-02-1985	Examiner REISER	CATEGORY OF CITED DOCUMENTS		<p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>	X : particularly relevant if taken alone			Y : particularly relevant if combined with another document of the same category			A : technological background			O : non-written disclosure			P : intermediate document		
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